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SCIENCE

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INSTITUTES OF ANTHROPOLOGY¹

THE anthropological problems of the present day are so numerous and so pressing that we can afford to select those of the greatest utility. Indeed, the three university institutes of anthropology I have suggested would have to specialize and then work hard to keep abreast of the problems which will crowd upon them. One might take the European races, another Asia and the Pacific, and a third Africa. America in anthropology can well look after itself. In each case we need something on the scale of the Paris Ecole d'Anthropologie, with its seventeen professors and teachers, with its museums and journals. But we want something else—a new conception of the range of problems to be dealt with and a new technique. From such schools would pass out men with academic training fit to become officials, diplomatic agents, teachers, missionaries, and traders in Europe, in Asia or in Africa, men with intelligent appreciation of and sympathy with the races among whom they proposed to work.

But this extra-state work, important as it is, is hardly comparable in magnitude with the intra-state work which lies ready to hand for the anthropological laboratory that has the will, the staff and the equipment to take it up efficiently. In the present condition of affairs it is only too likely that much of this work, being psychometric, will fall into the hands of the psychologist, whereas it is essentially the fitting work of the anthropologist, who should come to the task, if fitly trained, with a knowledge of comparative material and of the past history, mental and physical, of mankind, on which his present faculties so largely depend. The danger has

¹ Concluding part of the address of the president of the Anthropological Section of the British Association for the Advancement of Science, Cardiff, 1920.

arisen because the anthropometer has forgotten that it is as much his duty to measure the human mind as it is his duty to measure the human body, and that it is as much his duty to measure the functional activities of the human body—its dynamical characters—as its statical characters. By dynamical characters I understand such qualities as resistance to fatigue, facility in physical and mental tasks, immunity to disease, excitability under stimuli, and many kindred properties. If you tell men that we are here trenching on the field of psychology and medicine, I reply: Certainly; you do not suppose that any form of investigation which deals with man—body or mind—is to be omitted from the science of man? If you do you have failed to grasp why anthropology is the queen of the sciences. The university anthropological institute of the future will have attached to it a psychologist, a medical officer and a biologist. They are essential portions of its requisite staff, but this is a very different matter from lopping off large and important branches of its fitting studies, to lie neglected on the ground, or to be dragged away, as dead wood, to be hewn and shapen for other purposes by scientific colleagues in other institutes. Remember that I am emphasizing that side of anthropology which studies man in the service of the state—anthropology as a *utile science*—and that this is the only ground on which anthropology can appeal for support and sympathy from state, from municipality, and from private donors. You will notice that I lay stress on the association of the anthropological institute with the university, and the reasons for this are manifold. In the first place, every science is stimulated by contact with the workers in allied sciences; in the second place, the institute must be a teaching as well as a researching body, and it can only do this effectively in association with an academic center—a center from which to draw its students and to recruit its staff. In the third place, a great university provides a wide field for anthropometric studies in its students and its staff. And the advantages are mutual. It is not of

much service to hand a student a card containing his stature, his weight, his eye color, and his head length! Most of these he can find out for himself! But it is of importance to him to know something of how his eye, heart, and respiration function; it is of importance to him to know the general character of his mental qualities, and how they are associated with the rapidity and steadiness of muscular responses. Knowledge on these points may lead him to a fit choice of a career, or at any rate save him from a thoroughly bad choice.

In the course of my life I have often received inquiries from schoolmasters of the following kind: We are setting up a school anthropometric laboratory, and we propose to measure stature, weight, height sitting, etc. Can you suggest anything else we should measure?

My invariable reply is: Don't start measuring anything at all until you have settled the problems you wish to answer, and then just measure the characters in an adequate number of your boys, which will enable you to solve those problems. Use your school as a laboratory, not as a weighhouse.

And I might add, if I were not in dread of giving offence: And most certainly do not measure anything at all if you have *no* problem to solve, for unless you have you can not have the true spirit of the anthropologist, and you will merely increase that material up and down in the schools of the country which nobody is turning to any real use.

Which of us, who is a parent, has not felt the grave responsibility of advising a child on the choice of a profession? We have before us, perhaps, a few meager examination results, an indefinite knowledge of the self-chosen occupations of the child, and perhaps some regard to the past experience of the family or clan. Possibly we say John is good with his hands and does not care for lessons; therefore he should be an engineer. That may be a correct judgment if we understand by engineer, the engine-driver or mechanic. It is not true if we think of the builders of Forth Bridges and Assuan Dams. Such men

work with the head and not the hand. One of the functions of the anthropological laboratory of a great university, one of the functions of a school anthropometric laboratory, should be to measure those physical and mental characters and their inter-relations upon which a man's success in a given career so much depends. Its function should be to guide youth in the choice of a calling, and in the case of a school to enable the headmaster to know something of the real nature of individual boys, so that that much-tried man does not feel compelled to hide his ignorance by cabalistic utterances when parents question him on what their son is fitted for.

Wide, however, as is the anthropometric material in our universities and public schools, it touches only a section of the population. The modern anthropologist has to go further; he has to enter the doors of the primary schools; he has to study the general population in all its castes, its craftsmen, and its sedentary workers. Anthropology has to be useful to commerce and to the state, not only in association with foreign races, but still more in the selection of the right men and women for the staff of factory, mine, office and transport. The selection of workmen to-day by what is too often a rough trial and discharge method is one of the wasteful factors of production. Few employers even ask what trades parents and grandparents have followed, nor consider the relation of a man's physique and mentality to his proposed employment. I admit that progress in this direction will be slow, but if the work undertaken in this sense by the anthropologist be well devised, accurate, and comprehensive, the anthropometric laboratory will gradually obtain an assured position in commercial appreciation. As a beginning, the anthropologist by an attractive museum, by popular lectures and demonstrations, should endeavor to create, as Sir Francis Galton did at South Kensington, an anthropometric laboratory frequented by the general population, as well as by the academic class. Thus he will obtain a wider range of material. But the anthropologist, if he is to advance his science

and emphasize its services to the state, must pass beyond the university, the school, and the factory. He must study what makes for wastage in our present loosely organized society; he must investigate the material provided by reformatory, prison, asylums for the insane and mentally defective; he must carry his researches into the inebriate home, the sanatorium, and the hospital, side by side with his medical collaborator. Here is endless work for the immediate future, and work in which we are already leagues behind our American colleagues. For them the psychometric and anthropometric laboratory attached to asylum, prison, and reformatory is no startling innovation, to be spoken of with bated breath. It is a recognized institution of the United States to-day, and from such laboratories the "fieldworkers" pass out, finding out and reporting on the share parentage and environment have had in the production of the abnormal and the diseased, of the anti-social of all kinds. Some of this work is excellent, some indifferent, some perhaps worthless, but this will always be the case in the expansion of new branches of applied science. The training of the workers must be largely of an experimental character, the technique has to be devised as the work develops. Instructors and directors have to be appointed, who have not been trained *ad hoc*. But this is remedying itself, and if indeed, when we start, we also do not at first limp somewhat lamely along these very paths, it will only be because we have the advantage of American experience.

There is little wonder that in America anthropology is no longer the stepchild of the state. It has demanded its heritage, and shown that it can use it for the public good.

If I have returned to my first insistence that the problems handled by the anthropologist shall be those useful to the state, it is because I have not seen that point insisted upon in this country, and it is because my first insistence, like my third, involves the second for its effectiveness—the establishment in our chief universities of anthropological institutes. As Gustav Schwalbe said of an-

thropology in 1907—and he was a man who thought before he spoke, and whose death during the war is a loss to anthropologists the whole world over—"a lasting improvement can only arise if the state recognizes that anthropology is a science preeminently of value to the state, a science which not only deserves but can demand that chairs shall be officially established for it in every university. . . . Only this spread of officially authorized anthropology in all German universities can enable it to fulfil its task, that of training men who, well armed with the weapon of anthropological knowledge, will be able to place their skill at the service of the state, which will ever have need of them in increasing numbers."²

Our universities are not, as in Germany, government-controlled institutions, although such control is yearly increasing. Here we have first to show that we are supporting the state before the state somewhat grudgingly will give its support to us. Hence the immediate aim of the anthropologist should be—not to suggest that the state should *a priori* assist work not yet undertaken, but to do what he can with the limited resources in his power, and when he has shown that what he has achieved is, notwithstanding his limitations, of value to the state, then he is in a position to claim effective support for his science.

I have left myself little time to place fairly before you my third insistence.

ADOPTION OF A NEW TECHNIQUE

What is it that a young man seeks when he enters the university—if we put aside for a moment any social advantages, such as the formation of lifelong friendships associated therewith? He seeks, or ought to seek, training for the mind. He seeks, or ought to seek, an open doorway to a calling which will be of use to himself, and wherein he will take his part, a useful part, in the social organization of which he finds himself a member. Much as we may desire it, in the pressure of

modern life, it is very difficult for the young man of moderate means to look upon the university training as something apart from his professional training. Men more and more select their academic studies with a view to their professional value. We can no longer combine this senior wranglership with the pursuit of a judgeship; we can not pass out in the classical tripos and aim at settling down in life as a Harley Street consultant; we can not take a D.Sc. in chemistry as a preliminary to a journalistic career. It is the faculties which provide professional training that are crowded, and men study nowadays physics or chemistry because they wish to be physicists or chemists, or seek by their knowledge of these sciences to reach commercial posts. Even the very faculty of arts runs the danger of becoming a professional school for elementary school teachers. I do not approve this state of affairs; I would merely note its existence. But granted it, what does anthropology offer to the young man who for a moment considers it as a possible academic study? There are no professional posts at present open to him, and few academic posts.³ There is little to attract the young man to anthropology as a career. Is its position as a training of mind any stronger? The student knows if he studies physics or chemistry or engineering that he will obtain a knowledge of the principles of observation, of measurement, and of the interpretation of data, which will serve him in good stead whenever he has to deal with phenomena of any kind. But, alas! in anthropology, while he finds many things of surpassing interest, he discovers no generally accepted methods of attacking new problems, *quot homines, tot sententiæ*. The type of man we want in anthropology is precisely the man who now turns to mathematics, to physics and to astronomy—the man with an exact

³ In London, for example, there is a reader in physical anthropology who is a teacher in anatomy, and a professorship in ethnology, which for some mysterious reason is included in the faculty of economics and is, I believe, not a full-time appointment.

² *Correspondenz Blatt*, Jahrg. XXXVIII., S. 68.

mind who will not take statements on authority and who believes in testing all things. To such a man anthropometry—in all its branches, craniometry, psychometry and the wide field in which body and mind are tested together under dynamic conditions—forms a splendid training, *provided* his data and observations are treated as seriously as those of the physicist or astronomer by adequate mathematical analysis. Such a type of man is at once repelled from our science if he finds in its text-books and journals nothing but what has been fitly termed “kindergarten arithmetic.” Why the other day I saw a paper by a distinguished anthropologist an attempt to analyze how many individual bones he ought to measure. He adopted the simple process of comparing the results he obtained when he took 10, 20, 30 individuals. He was not really wiser at the end of his analysis than at the beginning, though he thought he was. And this, notwithstanding that the whole matter had been thrashed out scientifically by John Bernoulli two centuries ago, and that its solution is a commonplace of physicist and astronomer!

How can we expect the scientific world to take us seriously and to treat anthropology as the equal of other sciences while this state of affairs is possible? What discipline in logical exactness are we offering to academic youth which will compare with that of the older sciences? What claim have we to advise the state until we have introduced a sounder technique and ceased to believe that anthropometry is a science that any man can follow, with or without training? As I have hinted, the problems of anthropology seem to me as subtle as those of physical astronomy, and we are not going to solve them with rusty weapons, nor solve them at all unless we can persuade the “brainy boys” of our universities that they are worthy of keen minds. Hence it seems to me that the most fertile training for academic purposes in anthropology is that which starts from anthropometry in its broadest sense, which begins to differentiate caste and class and race, bodily and mental health and disease, by measure-

ment and by the analysis of measurement. Once this sound grounding has been reached the trained mind may advance to ethnology and sociology, to prehistory and the evolution of man. And I shall be surprised if equal accuracy of statement and equal logic of deduction be not then demanded in these fields, and I am more than half convinced, nay, I am certain, that the technique the student will apply in anthropometry can be equally well applied in the wider fields into which he will advance in his later studies. Give anthropology a technique as accurate as that of physics, and it will forge ahead as physics has done, and then anthropologists will take their due place in the world of science and in the service of the state.

Francis Galton has a claim upon the attention of anthropologists which I have not. He has been president of your institute, and he spoke just thirty-five years ago from the chair I now occupy, pressing on you for the first time the claims of new anthropological methods. In Galton's words: “Until the phenomena of any branch of knowledge have been submitted to measurement and number it can not assume the status and dignity of a science.” Have we not rather forgotten those warning words, and do they not to some extent explain why our universities and learned societies, why the state and statesmen, have turned the cold shoulder on anthropology?

This condition of affairs must not continue; it is good neither for anthropology, nor for the universities, nor for the state if this fundamental science, the science of man, remains in neglect. It will not continue if anthropologists pull together and insist that their problems shall not fail in utility, that their scientific technique shall be up to date, and that anthropological training shall be a reality in our universities—that these shall be fully equipped with museums, with material, with teachers and students.

It is almost as difficult to reform a science as it is to reform a religion; in both cases the would-be-reformer will offend the sacrosanct upholders of tradition, who find it hard to discard the faith in which they have been reared.

But it seems to me that the difficulties of our time plead loudly for a broadening of the purpose and a shapening of the weapons of anthropology. If we elect to stand where we have done a new science will respond to the needs of state and society; it will spring from medicine and psychology, it will be the poorer in that it knows little of man's development, little of his history or pre-history. But it will devote itself to the urgent problems of the day. The future lies with the nation that most truly plans for the future, that studies most accurately the factors which will improve the racial qualities of future generations either physically or mentally. Is anthropology to lie outside this essential function of the science of man? If I understand the recent manifesto of the German anthropologists, they are determined it shall not be so. The war is at an end, but the critical time will be with us again, I sadly fear, in twenty to thirty years. How will the states of Europe stand then? It depends to no little extent on how each of them may have cultivated the science of man and applied its teaching to the improvement of national physique and mentality. Let us take care that our nation is not the last in this legitimate rivalry. The organization of existing human society with a view to its future welfare is the crowning task of the science of man; it needs the keenest-minded investigators, the most stringent technique, and the utmost sympathy from all classes of society itself. Have we, as anthropologists, the courage to face this greatest of all tasks in the light of our knowledge of the past and with our understanding of the folk of to-day? Or shall we assert that anthropology is after all only a small part of the science of man, and retreat to our study of bones and potsherds on the ground that science is to be studied for its own sake and not for the sake of mankind? I do not know what answer you will give to that question, yet I am convinced what the judgment of the future on your answer is certain to be.

KARL PEARSON

SULPHUR AS A FERTILIZER

INFORMATION concerning the relation of sulphur to plant nutrition and growth has been accumulating during the last decade, and the mass of data has now become so important that it demands recognition of all investigators of nutritional problems. Indeed, it seems to me that much of our past experimental field work dealing with the influence of fertilizer elements upon plants has been so loosely done that we are under the necessity of reexamining the whole matter.

Although the value of sulphur, particularly in the form of gypsum, was recognized at an early period in our national history, the lack of uniform success with it soon led to its neglect as an important fertilizer. And after the invention of acid phosphate about the middle of the last century, the development was almost wholly toward soluble fertilizers containing nitrogen, phosphorus, and potassium. Sulphur was not included as a part of a complete fertilizer, although it was recognized as necessary to plant growth. The soil was thought to contain enough sulphur, and plants to need so little of it, that it was added to the soil only incidentally, as in acid phosphate, potassium sulphate, or ammonium sulphate, along with the three elements forming the so-called "complete" fertilizer.

Experiment station workers and other students of mineral nutrition of plants fell into loose ways of working with fertilizer salts. They have not hesitated to use sulphur-containing nitrogenous compounds when testing the influence of increased nitrogen on plant growth. Similarly the acid phosphate has been used in testing the effects of phosphorus; and potassium sulphate has been used when potassium was under observation. In comparing various forms of fertilizer elements we find the superphosphate for instance pitted against bone meal; or potassium sulphate against potassium chloride; or ammonium sulphate against sodium nitrate as a source of nitrogen. It is evident that such tests as these are all invalid if sulphur itself is shown to be an important fertilizer element. For the ex-